Fiber Optic Transmission Throughput Increase of 200-Fold by Addition of Deliberate Variance in Light Intensity, Changes to Switching Protocol

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Introduction

Data is transmitted over fiber-optic lines using a single frequency of blue light chosen for its quality of being able to travel the greatest distance without degradation with comparison to other frequencies. The possibility of emitting multiple frequencies has been explored and rejected as offset frequencies would self-interact and ultimately corrupt data. The possibility of using multiple polarities runs into the same problem.

Abstract

Existing traffic routing equipment is exceptionally adept at the diagnostic measurement of the intensity of light so as to be able to identify when a signal is too weak to be consistently relayed to the destination. This sort or data regarding light intensity is currently only being used diagnostically and not being utilized as fully as it might be.

Every computer connected to the Internet has a ping time that depends on traffic routing and the latency of switching equipment (traffic load-dependent.) Ping times are not entirely unique to nodes and can vary quite a bit. Under ideal conditions, ping times can be used to estimate the geographic region of a user.

Light intensity (the amplitude property of light waves as opposed to the frequency of pulses or the wavelength) is potentially variable but does not tend to change from end to end unless a length of cable is replaced somewhere on the route or a plug is loosened or tightened. In the time it takes for most files to transfer, however, there should be no change to light intensity along a single end-to-end route.

Traditionally, signals are transmitted and retransmitted at each node along the way at a uniform brightness, but with the only absolute requirement being that light be bright enough when arriving at the destination to be interpreted. The exact brightness of each light emitter is an aspect of quality control that has gone overlooked in favor of the ability to rapidly switch on and off the lights. If we added to this traditional switching mechanism a dimension of fine control over brightness or light amplitude, we could encode greater quantities of data by encoding part of that data into the amplitude of a pulse in addition to patterns of either "on" or "off."

If switching equipment could discern 200 distinct amplitudes of light, for instance, in addition to the current capabilities, (with all of those falling within 99% and 100% of what is now considered "full amplitude,") rather than each pulse conveying one "bit," each of those bits could, in addition to being either "long or short," could also be of one of 200 discernible intensities. Thus, each

pulse could convey 200 bits instead of one. Thus, a fiber backbone line that can currently move 500 trillion bits per second would suddenly be able to convey 100 quadrillion bits in that same second.

Crucial to realizing this capability is are two simple changes to the current data transfer protocol. The first is that we no longer take received signals at relay nodes and reset their brightness to "max" but rather, increase brightness by an amount relative to the detected brightness to get it at least "close to max." Two end users in different parts of the country or world would follow up their initial "handshake" with another that serves to calibrate signal strengths by ascertaining what a "100% strength" signal looks like to one another's equipment and what each notch between 99% and 100% looks like. This measurement will be different for every pair of computer systems on the Internet and would need to be checked at the outset of each file transfer. This calibration would add only a trivial (nearly undetectable) latency to the outset of each transfer. Users located closer to their local ISP home office and closer overall to the server they wish to communicate with would be able to use an even higher multiplier setting for their communications and this multiplier (the variety of amplitudes used) can be increased or decreased depending upon these factors. These benefits would become even more pronounced in future systems based upon the superconduction of light (where distance does not diminish or distort signals.)

Each time a bit is sent in this proposed system, it is at a different intensity; deliberately varied by increments of 1/200th of one percent of the total amplitude of a standard pulse.

All that is needed for this to work is for ISPs to use switching equipment that measures precisely light's intensity and increases it upon retransmission by a predetermined absolute amount relative to what is received rather than emitting all signals at one standard amplitude. For this to work, every ISP in the network needs conform to operate on this principle, as would every network card. Importantly, this proposed system can take advantage of the existing fiber infrastructure. Fundamentally, this approach takes advantage of the fact that optical signal degradation rates along specific routes tend to remain predictable in the short term.

Conclusion

A sudden 200-fold increase in total throughput should justify making the proposed changes as it would open up the possibility of home users enjoying speeds approaching 1 terabit per second depending upon the level of refinement of this approach.